

10.07 Insulation & Roofing Felts

- a. organic materials
- b. mineral products
- c. acoustic products
- d. tarred felt
- e. felt roofing
- f. asbestos products
- g. Malthoid
- h. proprietary materials
- i. felt shingles

Insulation, prior to the introduction of reflective foil, generally consists either of loose particulate or fibrous materials obtained locally, like sawdust, seagrass, straw or grass of various sorts, or of manufactured materials imported from Britain. The former especially tend to be undatable, but the King's Head Inn (later 'Valleyfield') at New Norfolk, Tasmania, was built in about 1822-5 with sand insulation in the ceilings.¹

a. organic materials

In the very first years of the Swan River settlement the Colonial Secretary, P N Broun, packed quantities of paperbark (*melaleuca*) between his ceiling and the shingle roof above.² By 1850, according to Robin Boyd, tan bark was being laid on ceilings as insulation below slate roofs.³ In 1883 the 'Villa Alba' near Melbourne was insulated with shredded bark packed between the ceiling joists of the top floor. In addition there was a 'matting of bitumenized grasses and vegetable matter in a compact felt-like layer' on top of the timber roof sarking, secured with battens running down the slope, over which were transverse battens to carry the roof slating. Although the felting must be read as heat insulation, the bark must have been meant to attenuate noise. Cleats are fixed to either side of the joists, and short boards span between these, about 70 mm below the top surface of the joists. Loose bark fills the space above the boards.⁴

Sawdust was reportedly used in the 1860s to insulate the second storey walls of Jacob Kircher's distillery at Aschmanhausen, on the Darling Downs.⁵ It was also specified to be used between floors at 'Martindale Hall', South Australia, of 1879, but in the event a plaster mortar was used instead.⁶ It was

¹ G T Stilwell, 'Valleyfield, Tasmania', in John Moore et al, *Historic Homesteads of Australia Volume Two* (Stanmore [NSW] 1976), p 22.

² J M R Cameron, 'The Colonization of Pre-Convict Western Australia' (PhD, University of Western Australia), p 215, ref Martin Doyle [ed], *Extracts from the Letters and Journals of George Fletcher Moore* (London 1834), p 185.

³ Robin Boyd, *Australia's Home* (Melbourne 1952) p 140.

⁴ Pru Sanderson Design Pty Ltd, *Villa Alba Conservation Analysis* (no place 1989), p 2/12 & fig 19.

⁵ Meg Cook, *Sandstone and Cedar* (Toowoomba [Queensland] 1984), p 14.

⁶ Information from Bruce Harry, 1991.

used in 1887 over the ceilings of the women's ward of the Benevolent Asylum (former Immigrants' Home), Melbourne.⁷ In 1889 G Adams's 'marine villa' at Hunters Hill, Sydney, had timber-framed walls faced externally in redwood rustic boarding and filled with cedar sawdust.⁸ Sawdust was used extensively at Bishop's Lodge, Hay, New South Wales, of 1888, both as a 75 mm layer on the ceilings and as a 150 mm thickness in the cavity of the iron-clad walls.⁹ Similarly, the Department of Lands Office at Hay, New South Wales, of 1895, had walls of corrugated iron externally, and ripple iron internally, with sawdust in between.¹⁰ Sawdust was likewise used in the Dr Wight house at Kyabram, Victoria, of 1907. It was frequently used in cool rooms, dairies &c - for example in the old butter factory at Penola, South Australia.¹¹ The January 1892 number of the *Farmer & Grazier* discussed the use of sawdust in ice houses, but as the article seems to have been recycled from North America (where ice houses were common) it tells us only what Australians might have heard of, not what they built. The ice house illustrated was a simple square building clad in timber boarding, in which the sawdust was not integral to the structure at all, but was placed around the ice as it was packed.¹² At the house 'Warra', Wangaratta, Victoria, of 1908, the ceilings are reportedly insulated with a layer of wood chips.¹³

An example of what appears to be seagrass is found in the cool room ceiling at 'Marida Yallock' near Camperdown, Victoria, but given the location it is more probably some local water weed or other vegetable product. The idea of using seaweed for insulation was reported in 1858 as if it were a novelty, having been proposed in France by a M Lagout.¹⁴ Both seaweed and sawdust were used by the Melbourne architect G R Johnson in the Theatre Royal, Adelaide (1877-8), and the Meat Market, North Melbourne (1879-80).¹⁵ A house in Mildura, Victoria, when rebuilt in 1894 following a fire, had the walls surfaced inside and out with ripple iron, with seaweed filling the 150 millimetre space in between.¹⁶ In Adelaide seaweed was also used in the Joachim Wendt house in East Terrace, and it still survives in the top floor of the Adelaide Club, laid over boarding.¹⁷ It was likewise used by Thomas

⁷ *Australasian Builder & Contractor's News*, 25 June 1887, p 109.

⁸ *Australasian Builder & Contractor's News*, 10 August 1889, p 137.

⁹ M L Gardam, *The Bishop's Lodge* (Hay [NSW] 1993), p 13, quoting *Riverine Grazier*, 20 August 1889.

¹⁰ Peter Freeman, *The Homestead: a Riverina Anthology* (Melbourne 1982), p 217.

¹¹ Information from Bruce Harry, 1991.

¹² *Farmer & Grazier*, January 1892, p 9: the article is unsourced, but probably from the *Country Gentleman*.

¹³ Information from the owner, Mr Harrington, January 2000.

¹⁴ *South Australian Register*, 18 May 1858, quoted in E & R Jensen, *Colonial Architecture in South Australia* (Adelaide 1980), p 181.

¹⁵ *Argus*, 16 December 1880, p 6. For the latter see also G R Johnson, 'Bill of Quantities. Metropolitan Meat Market. Bank, Hotel, and Two Shops, &c.' (Melbourne 1879), p 11, which indicates that this mixture was a three inch [75 mm] layer over the ceiling, covered in turn with 3/4 inch [19 mm] rough boarding.

¹⁶ *Mildura Cultivator*, 10 February 1894, quoted in Andrew Ward, *"Rio Vista" Conservation Analysis* (no place, 1988), p 177.

¹⁷ Information from Paul Stark, 1991.

English in the South Australian Club,¹⁸ and for the Glenelg Institute (1878).¹⁹ It is also found in Kay's Amery Winery and other country wineries,²⁰ despite the fact that most are distant from the coast. In 1909 a Department of Agriculture publication recommended the use of seaweed laid on sheets of paper as a ceiling insulation for use in the coastal areas of South Australia,²¹ and in the 1920s the Riverina architect A C Macknight recommended 150 mm of seaweed in ceilings, explaining that straw was less desirable because it gave off a mushy smell.²²

Although these products appear to be all of local origin, a manufactured product known as 'Cabot's Quilt' was available in the USA from 1893. It was made by the Samuel Cabot Company (better known for paints and stains) using eel grass (*Zostera marina*) between two layers of heavy paper. The plant had two main advantages, the first being that it remained loose and aerated, rather than consolidating into a block like some insulating materials. The second advantage was that the high silicon content of the plant rendered it non-combustible.²³

At 'Monalong' in the Riverina of New South Wales, east of Berrigan, the meat house has an insulating layer in the roof of a cane-like plant which still grows at the site [?kabundi grass].²⁴ Peter Freeman has cited other examples of cane grass insulation in the Riverina. Amongst the few purpose-manufactured materials of this sort was Alpinite 'heat resisting fibre', marketed by John Sanderson & Co of Sydney and Melbourne.²⁵ A miner's house at Whim Creek, Western Australia, in 1898, was unusual in that it had its insulation on top of rather than underneath an iron roof. This was a neat pile of spinifex and brush, held in place with wire netting.²⁶ Charles Mayes proposed in 1860 that 'hair from cows, dogs, horses, cats, &c' should be made into hair felt for roof insulation,²⁷ and as he made no reference to the establishment of dog and cat farms for the purpose, he must have envisaged

¹⁸ *South Australian Register*, 6 December 1878; 8 September 1879; 1 January 1880, cited in Jensen, *Colonial Architecture*, p 619.

¹⁹ *South Australian Register*, 1 July 1876; 1 January 1877; 27 March 1877; 11 May; 29 July; 20 October 1877; 8 September 1879; 1 January 1880, cited in Jensen, *Colonial Architecture*, p 619.

²⁰ Information from Ron Danvers, 1991.

²¹ C E O Smyth, 'House-Building in the Back Blocks, No II', *Journal of the Department of Agriculture of South Australia*, XII, 5 (December 1908), pp 454-5, quoted in Bridget Jolly, 'Solomit in South Australia and its European Context' (PhD submission, University of South Australia, 1998), p 8.

²² A C Macknight, 'The Australian Country House', *Australian Home Builder*, May 1923, p 54, quoted in Alex Newell, 'The History of Mulwala Station Estate Homestead' (Building Research Project, Deakin University, 1998), p 19.

²³ Joanna Dowling, 'Blanketing the Home: the Use of Thermal Insulation in American Housing, 1920-1945', in *APT Bulletin*, XL, 1 (2009), p 34.

²⁴ Inspected January 2000

²⁵ *The Architectural Students Annual* (Melbourne 1913), p ix; C E Mayes, *The Australian Builders & Contractors' Price Book* (8th ed, Sydney 1914), advertisement p 39.

²⁶ Batty Library, 3044P, reproduced in Ian Evans, *The Australian House* (Sydney 1983), p 37.

²⁷ Charles Mayes, 'Manufactures for the Economical Development of the Resources of the Colony', in *Victorian Government Prize Essays 1860* (Melbourne 1861), p 383.

public-spirited citizens bringing their pets forward each shearing time to contribute. At 'Barroga', New South Wales, the wings of the house believed to have been built in the 1860s and the 1890s have ceilings insulated with loose wool.²⁸

Shingles were widely used, both as an insulating material; in their own right, and as a means of containing an insulation air space. The widespread practice of placing corrugated iron over a decayed shingle roof was sometimes adopted explicitly for insulation purposes, but usually, one may surmise, because it was simply the easiest thing to do. The creation of an air space was generally a factor in the design of dairies and cool rooms, as will appear below. Occasionally a similar approach was taken in other buildings, as with a Melbourne house advertised in 1855 in which 'With a view to coolness in the summer season, the roof is shingled and plastered under the slates.'²⁹

In 1881 Blackmann & Parkes designed a Swiss-style villa in the Blue Mountains at Springwood, with a corrugated iron roof, beneath which was 'a thickly whitewashed later of jute bagging, which is expected to act as a non-conductor for the sun's heat.'³⁰ The architects and their clients must have been sadly disappointed with the result. Early in 1889 it was announced that Frick, Caterall & Co of Sydney had been appointed agents for Brown Brothers' Rattipuc Roofing. What this comprised is not apparent, but it was described as a 'non-conducting, cool substance' which could be used under corrugated iron as a substitute for boarding.³¹

At the Orbost Butter Factory, Victoria, of 1882, the east wall was insulated with charcoal, as was the ceiling of the cool room.³² A number of cool stores built by the Victorian government in 1889 had hollow walls filled with charcoal, and it is found in the walls and door of the adjacent meat house and dairy at 'Kilmany Park', Victoria, of the early twentieth century. Charcoal is also in the walls, and probably also the door, of a coolroom at 'Memsie', Bridgewater, Victoria, which seems to date from after 1900.³³ It was also reportedly used in the 1890s in an addition to Jondaryan homestead, Queensland, between layers of galvanised iron,³⁴ and in 1908 charcoal was recommended for house ceiling insulation in South Australia.³⁵ Generally, however, it appears to have

²⁸ Information from the owner, Mr John Jarrett, January 2000.

²⁹ *Argus*, 29 September 1855, p 3.

³⁰ *Australian Engineering and Building News*, 1 April 1881, p 77.

³¹ *Australasian Builder & Contractor's News*, 9 February 1889, p 130.

³² Lauris White, 'The Orbost Butter and Produce Company, 1892-1917', *The Curlip*, 2 (August 1992), p 4.

³³ Inspected 2004.

³⁴ Susie Penfold & Sofie Todd, *Jondaryan Woolshed* (Jondaryan [Queensland] 1977), p 8.

³⁵ C E O Smyth, 'House-Building in the Back Blocks, No II', *Journal of the Department of Agriculture of South Australia*, XII, 5 (December 1908), pp 454-5, quoted in Bridget Jolly, 'Solomit in South Australia and its European Context' (PhD submission, University of South Australia, 1998), p 8.

been used only in more specialised building types, from the early twentieth century.³⁶

By the 1930s cork insulation branded 'Australcork' and 'Zeristo' was on sale in Victoria (the former by Cork Industries (Aust) and the latter by W H Brewer of North Melbourne).³⁷ It would compete with the wood fibre and cane boards which have been discussed already.

b. mineral products

Mineral wool became generally available in the 1870s. . As a material for lagging boilers and steam pipes it is said to have been also produced in Wales from about 1840,³⁸ but for practical purposes it was a much later development, and was reported to be a German invention of the 1870s.³⁹ Slag wool was produced at blast furnaces in Osnabrück and Zwickau, by sending the blast of air or steam through the molten slag, producing a white material like spun glass.⁴⁰ The maker was apparently Krupp, of Essen, and the material, known as *Schlackenwolle*, is said to have been of poor quality, and to have rapidly crumbled to powder. A type somewhat similar to the German wool was produced in the United States, as 'mineral wool.'⁴¹

As first developed, jets of steam or air were blown against a stream of molten slag, which produced fine vitrified fibres, but also a proportion of hard granules or shot, which was difficult to separate out without breaking the fibres and reducing the quality. But a Pennsylvanian inventor developed an arrangement of a number of jets imparted a swirling motion to the molten slag and converted the whole of it into what was classed as 'No 1 wool', of a light, soft and uniform quality.⁴² Mineral wool was used for purposes like pugging pipes and insulating partitions, in the latter case in the form of cakes of 'slag felt'.⁴³ By 1876 Edmund Beckett could write of 'that extraordinary-looking wool which is made by blowing steam into the slag of iron furnaces' as a material suitable for jacketing boilers, and for insulation generally.⁴⁴ The British believed that the wool produced in the Tees district by Charles Wood was far superior to the German or American types because of the special nature of the Cleveland slag. It was tough, elastic, and retained its consistency.⁴⁵

³⁶ For example, the cool room of the Willsmere Butter Factory, Maffra, Victoria, of 1922: Richard Aitken [ed], *Macalister Landscapes* (Bairnsdale [Victoria] 1994), p 70.

³⁷ W L Richardson, *Ramsay's Architectural and Engineering Specifications [Volume 1]* (Melbourne, no date [1934]), p 103.

³⁸ J G Mohr & W P Rowe, *Fiber Glass* (New York 1978), p 68, cited in Jason Tan, 'Mineral and Glass Fibre Insulation' (History of Building Construction essay, Melbourne University, 1995), p 2.

³⁹ *Australasian Ironmonger*, 1 April 1886, p 7.

⁴⁰ Wyatt Papworth [ed], *The Dictionary of Architecture* (London 1853-92), sv Slag Wool.

⁴¹ *Australasian Builder & Contractor's News*, 30 March 1889, p 291.

⁴² *Australasian Ironmonger*, 1 April 1886, p 7.

⁴³ Papworth, *Dictionary of Architecture*, sv Slag Wool.

⁴⁴ Edmund Beckett, *A Book on Building* (Crosby Lockwood, London 1876), p 193.

⁴⁵ *Australasian Builder & Contractor's News*, 30 March 1889, p 291.

The first reference to the use of slag wool in Australia was in 1887, when it was 'substituted for the usual pugging' in the floors, being placed upon light boards, presumably spanning between joists at some distance from the floor surface. The origin of the material used is unknown, but it is likely to have been British.⁴⁶ By 1901 slag wool or 'silicate cotton' was being made by D Anderson & Son of London (apparently the successors of David Anderson of Belfast); J C Broadbent & Co Ltd, of Redcar and Hazlehead near Sheffield (who cited contracts going back to 1893); Frederick Jones & Co of London; and F McNeill & Co of London, with works at Kirkintilloch near Glasgow.⁴⁷ By the 1920s McNeills manufactured 'Slagbestos', though it is unclear whether it in fact contained asbestos.⁴⁸

Slag wool was later made by mixing particular types of stone with molten blast furnace slag, and forming it into fibres, and (at least in the United States) this was most common type of mineral wool.⁴⁹ It seems to have been introduced in Australia in the early 1950s by Australuco.⁵⁰ This was developed into four main products: a loose wool like fluffy white cotton; a granular form in pellets of about six millimetres diameter (both forms which could be used between ceiling joists); a 'blanket' of felted slag wool stitched to a kraft paper backing, for use in partitions and under rafters; and two inch [53 mm] batts, mainly for use between wall studs. They also produced pre-formed sections for insulating pipes, and a so-called 'slag cork' for both pipes and boilers.⁵¹

The second mineral product was rock wool, which was made from basalt⁵² or granite heated to 1,650°C, was totally free of sulphur, and was claimed to be the only odourless type.⁵³ The first rock fibre insulation in Australia, known as 'Insulwool', was advertised from March 1944.⁵⁴ It presumably derived from the hyphenated American product Insul-Wool, made by the Insul-Wool Corporation of Wichita, Kansas, and Cleveland, Ohio.⁵⁵ It was sold in Australia in pellet form as 'granulated Insulwool', and in blankets and batts, like slag wool, but apparently not in loose wool form.⁵⁶ It was said to be a mass of gossamer fine filaments blasted from molten rock by high pressure

⁴⁶ *Australasian Builder & Contractor's News*, 3 December 1887, p 490.

⁴⁷ J E Sears [ed] *The Contractors, Merchants, and Estate Managers' Compendium and Catalogue* (15th ed, London 1901), pp following 72, 73, 77, following 78.

⁴⁸ *The Colonial Compendium & Export Catalogue of the Building Trades* (London 1924), p 37.

⁴⁹ F E Kidder & Harry Parker, *Kidder-Parker Architects and Builders' Handbook* (18th ed, New York 1931), p 2025.

⁵⁰ *Building, Lighting and Engineering*, 24 November 1952, p 35.

⁵¹ F Wentworth & W L Richardson [eds], *Ramsay's Architectural and Engineering Catalogue* (Melbourne 1949), §26/2.

⁵² Joanna Dowling, 'Blanketing the Home: the Use of Thermal Insulation in American Housing, 1920-1945', in *APT Bulletin*, XL, 1 (2009), p 36.

⁵³ Kidder & Parker, *Architects and Builders' Handbook* (1931), p 2025.

⁵⁴ *Australian Home Beautiful*, March 1944, cited by Peter Cuffley, *Australian Houses of the Forties and Fifties* (Knoxfield [Victoria] 1993), p 84.

⁵⁵ Dowling, 'Blanketing the Home', p 35.

⁵⁶ Wentworth & Richardson, *Ramsay's Catalogue* (1949), §26/3.

steam jets, so that 90% of the volume was air.⁵⁷ A third material, glass fibre was first made by the Corning Glass Co of the USA in 1931.⁵⁸ It was introduced in Britain by Chance brothers in the early 1930s, and in 1938 they joined forces with Pilkingtons to form Glass Fibres Ltd.⁵⁹ It was not manufactured in Australia for some considerable time.

Another mineral product was expanded shale, already mentioned above as an additive in lightweight concrete. The leading type in Australia was Vermiculite, distributed by the Neuchatel Asphalte Company of Sydney. It was said to have been widely used already in South Africa and North America for various insulation and acoustic purposes. In Australia it was available by 1949 as loose fill for wall space, as well as aggregate for its role in lightweight concrete and in insulating plaster.⁶⁰

Foamed plastic became important after World War II, when the Hardie Rubber Company produced a foam slab called 'Coolite' in sizes up to 8 ft x 4 ft x 20 in [2.4 x 1.2 x 0.51 m], but capable of being sliced as thin as 1/16 inch [1.5 mm].⁶¹ Foil insulation had become viable in the USA in the 1930s as aluminium became more readily available,⁶² and It seems to have been introduced to Australia by Australuco in the early 1950s.⁶³

c. acoustic products

Specifically designed acoustic insulation, as at the Villa Alba discussed above, was a rarity until the general lightening of construction, and the development of sound intensive and sound sensitive functions, such as cinemas for talking pictures. The manufactured acoustic materials which now emerged were all more or less novel, but they included conventional boards and sheets of various sorts which were perforated to make them absorbent. All the local products derived more or less directly from European and American products, but American materials like Cabot's Quilt, the Rumford Tile, Sahinite sound absorbing plaster, Akoustikos Asbestos Felt, Nashkote, Cushocel and Sancoustic tiles⁶⁴ have not been reported in Australia.

Between the wars Celotex was used for acoustic purposes in the Melbourne Town Hall, Brisbane City Hall, other Brisbane buildings, and various South Australian public buildings, as discussed above. In 1949 Insulwool Products Pty Ltd were marketing 'Perfosteel', 'Perfopoly' and 'Perfotile', made severally

⁵⁷ Royal Australian Institute of Architects W A Chapter, *Exhibition 1949 Catalogue* (Perth 1949), p 35.

⁵⁸ Dowling, 'Blanketing the Home', p 38.

⁵⁹ Marian Bowley, *Innovations in Building Materials* (London 1960), p 286.

⁶⁰ Ware & Richardson, *Ramsay's Catalogue* (1949), §26/5.

⁶¹ *Architecture in Australia*, September 1959, pp 14-16

⁶² Dowling, 'Blanketing the Home', p 38.

⁶³ *Building: Lighting: Engineering*, 24 November 1952, p 35..

⁶⁴ A E Weber, 'Acoustical Materials', in T C Jester, *Twentieth-Century Building Materials* (Washington [DC] 1995), pp 262, 264.

of 26 gauge steel, plywood, and fibrous plaster in two foot [600 mm] square panels, in each case perforated and backed with slag wool.⁶⁵ By 1954 they were advertising the 'Frenger Radiant Ceiling', which consisted of twelve inch [300 mm] square perforated aluminium panels with Insulwool on top.⁶⁶ Picton Hopkins of Melbourne made slightly larger acoustic tiles called 'Silenceil', like perforated plaster trays with flanged edges to contain a section of mineral wool blanket behind.⁶⁷ In the 1950s there appeared Cane-ite acoustic tiles and wallboard, a perforated fibrous plaster tile called 'Hushtile', and others. More elaborate was 'Ceil-Sound No. 1', which was made in Western Australia by H B Brady Co Pty Ltd of Bayswater: this was a perforated [metal] box tile filled with slag wool, and had been tested in England by the National Physical Laboratory at Teddington.⁶⁸

d. tarred felt

Manufactured roofing materials are mostly bitumenised, and can be seen as descendants of the roofing felt impregnated with wood tar which had been introduced in Sweden in the eighteenth century.⁶⁹ According to Lewcock, black tarred felt roofs were already becoming common in Cape Town in the 1790s,⁷⁰ so there is no reason why they might not have appeared in Australia at any time. Bitumenised felt roofing is said to have been used in the 1840s in Boston, and at Newark, New Jersey,⁷¹ but the major products were developed in Britain.

In 1833 McNeill's 'Lion' brand felt came onto the British market,⁷² and by 1840 a product known as Pocock's Patent Flexible Roofing was available in England, claiming to be lightweight, waterproof, heat insulating, dimensionally stable, and resistant to pressure and to temperatures up to 104°C.⁷³ It was intended, according to Loudon, to supersede the use of slates, tiles and other materials in the covering and lining of a variety of buildings, and it was already in very general use by 1846. It was made from the refuse felt of hatters, together with natural or artificial asphalt, pressed into thin plates.⁷⁴ By 1844

⁶⁵ Ware & Richardson, *Ramsay's Catalogue* (1949), §26/4. See also F W Ware & W L Richardson [eds], *Ramsay's Architectural and Engineering Catalogue* (Melbourne 1954), §26/1.

⁶⁶ Ware & Richardson, *Ramsay's Catalogue* (1954), §26/1.

⁶⁷ Ware & Richardson, *Ramsay's Catalogue* (1949), §26/6.

⁶⁸ Barbara van Bronswijk, 'The Design of Professional Chambers for General Practitioners in Western Australia, 1945-1960' (MA, Curtin University, 1994), pp 93-4.

⁶⁹ Pedro Guedes, *The Macmillan Encyclopedia of Architecture and Technological Change* (London 1979), p 250.

⁷⁰ Ronald Lewcock, *Early Nineteenth Century Architecture in South Africa* (Cape Town 1963), pp 8, 385.

⁷¹ Mike Jackson, 'Asphalt Shingles', in Jester, *Twentieth-Century Building Materials*, p 248.

⁷² This is the date claimed by McNeill & Co in *The Colonial Compendium & Export Catalogue of the Building Trades* (London 1924), p 35.

⁷³ *Mechanic's Magazine*, XXXII, 865 (7 March 1840), p 432.

⁷⁴ J C Loudon, *An Encyclopædia of Cottage, Farm and Villa Architecture* (London 1846 [1833]), §2448, p 1250.

at least two other types of roofing felt were on the market in England, one of which, Croggon's, was to become the most prominent type.

Croggon's felt consisted of hair and hemp felted together and saturated with mineral asphalt, and was recommended to be laid over thin (say quarter inch [6 mm]) close boarding, with sheets overlapping 38 mm and held down with copper nails, then sealed with a mixture of coal tar and lime.⁷⁵ Its inventor, Thomas John Croggon, claimed that it was the only one which contained hair, and in which asphalt was used with no admixture of pitch, tar or resin.⁷⁶ By 1851 Croggon was stressing its lightness, forty-two pounds per hundred square feet [2.1 kg per square metre], and requiring it to be stretched smooth, though a lap of only one inch [25 mm] was now considered necessary. Although copper nails were preferred, it was possible to use twopenny fine clout nails (of iron), which were to be heated in a shovel and thrown into grease while hot, so as to prevent rust. The coal tar and lime coating was to be renewed every four or five years.⁷⁷ Croggon's was listed in Mayes's price book in 1861,⁷⁸ and doubtless used in Australia.

The competitors were McKibbin's Improved Roofing Felt and F McNeill & Co's Improved Patent Asphalted Felt, of which McNeill's appears to have been the more popular, and sold in the same width and at the same price as Croggon's.⁷⁹ At the Great Exhibition McNeills showed their 'patent asphalted roofing felt' and described it a 'a mixture of flax and hair, saturated with mineral bitumens, and finished by machinery'.⁸⁰ In 1853 McNeills shipped four cases of 'patent roofing', apparently the same as what is referred to as four thousand square feet [372 m²] of 'asphalted felt', to Sydney for use in the new Mint.⁸¹ Both Croggon and McNeill also sold a 'dry hair felt' more specifically suited to insulation than to roofing or sarking, and recommended for the lagging of pipes and boilers, and for sound insulating partitions.⁸² In the 1920s McNeill's 'Lion' brand roofing was described as being 'made from the finest long-fibred Raw Felt, thoroughly saturated and impregnated with natural asphalt ... and surfaced with a harder though similar compound of remarkable tenacity and elasticity'.⁸³ The brand continued into the twentieth century, and felt branded "RED HAND" INODOROUS FELT' has been found

⁷⁵ *Builder*, II, 33 (10 February 1844), p 62.

⁷⁶ *Builder*, III, 117 (3 May 1845), p 216.

⁷⁷ London, Great Exhibition of the Works of Industry of all Nations, 1851, *Official Descriptive and Illustrated Catalogue* (3 vols, London 1851), I, p 323. See also vol I, advertisements p 53.

⁷⁸ Charles Mayes, *The Australian Builders' Price-Book* (2nd ed, Melbourne 1862), p 149.

⁷⁹ *Builder*, II, 86 (8 September 1844), p 500; 85 (21 September 1844), p 488; III, 116 (26 April 1845), p 2104.

⁸⁰ London, Great Exhibition, 1851, *Catalogue*, I, p 325.

⁸¹ Archives Office of New South Wales, R97, p 1, summary of goods shipped aboard the *Maid of Judah*, cited in Fiona Starr et al, *The Royal Mint, Sydney (1853-1926): a Survey of the Documents Associated with the Mint* (Sydney 2001), p 18.

⁸² *Builder*, II, 53 (10 February 1844), p 62; III, 117 (3 May 1845), p 216.

⁸³ *The Colonial Compendium & Export Catalogue of the Building Trades* (London 1924), p 36.

in a church of 1907-8 in the course of moving it to the Weald and Downland Museum, England.⁸⁴

McKibbin's felt is not known to have been used in Australia. By 1849 yet another firm, Grueber & Co, were producing a patent asphalt felt,⁸⁵ and in that year David Anderson began manufacturing 'Red Hand' brand tarred flax felt, at the Logan Felt Works, Belfast. Anderson's business grew rapidly and he took his son James into partnership in 1853, and supplied large quantities of felt to the forces in the Crimean War in 1854-6.⁸⁶ Théodore Chateau refers also to an English incombustible roofing felt which was now being made in France, presumably under licence, by Roques & Bourgeois at Ivry-sur-Seine.⁸⁷ In the United States by 1876 Cyrus J Fay was advertising waterproof hemp and manilla felting for exterior and interior cladding purposes.⁸⁸

Only at one early site has a reasonably unequivocal specimen of such a felt been found. At 'Don Bank' in North Sydney there has been found in places between the timber and plaster a moisture-proof material which is now on display, and which has been identified as vegetable fibre impregnated with a bitumenised substance. This probably dates from 1854, which seems to be the effective date of the building, despite a puzzling fragment of 1835 newspaper found beneath wallpaper.⁸⁹ In the Melbourne suburb of St Kilda there was in Grey Street a 'a curious block of cottages built mainly of felt, the corner one being octagonal',⁹⁰ and in 1889 the charcoal insulated Victorian Government cool stores, referred to above, had 'Felting, coated with a patent composition' on the outside woodwork, intended to prevent damp and heat.⁹¹ The post-1906 cool store at 'Memsie', mentioned earlier for its charcoal insulation, was totally clad in tarred felt. held in place with a grid of timber battens.⁹²

e. felt roofing

The use of impregnated felts for flat roofs follows logically from the earlier use of tarred canvas, which will be discussed in the context of flat roofs, and there was in fact a whole family of products based upon the impregnation of cloth, felt or paper with tarry substances. Coal tar was used in the 1850s, as it was a useless residue of the process of gas generation, prior to the discovery of aniline dyes in 1856. The idea originated with Samuel D Warren of Cincinnati,

⁸⁴ Richard Harris, 'The Museum acquires a "Tin Tabernacle"', *Weald & Downland Museum*, Autumn 2006.

⁸⁵ *Builder*, VII, 311 (20 January 1849), p 35.

⁸⁶ John Routley [ed Harold Mattingly], *A Saga of British Industry* (London 1959), p 141.

⁸⁷ Théodore Chateau, *Technologie du Bâtiment* (2 vols, Paris, 1863, 1866), II, p 317.

⁸⁸ C J Fay, *Water-Proof, Hemp and Manilla Felting, for covering outside and inside of buildings, floors, &c* (Camden [New Jersey], no date [1876]), listed in Charles Wood, *Catalogue 129* (Cambridge [Massachusetts] 2006), no 68.

⁸⁹ Information from Denis Gojak, Curator.

⁹⁰ Chapman, 'South Suburban Melbourne', quoted by Ian Tudball, BArch, University of Melbourne.

⁹¹ *Australasian Builder & Contractor's News*, 11 May 1889, p 436,

⁹² Inspected 2004.

Ohio, who had begun a roofing business in 1844, using paper and pine tar to cover flat roofs. He experimented with the use of coal tar to soften the pine tar, and was so successful that he turned to coal tar exclusively, especially as he found that gas plants would pay him to take the material away. His business grew rapidly, and his four brothers established branches in six cities in the United States. In 1857 he established a distilling plant for coal tar pitch, which was a much more stable material than the crude tar. By the end of the century coal tar production had become one of America's largest industries.⁹³

A dairy building at 'Reedy Creek', Woodside North, East Gippsland, dates from 1899 and has a roof of 150 mm boards spaced 150 mm apart and covered in a bitumenised material. This may be Croggon's felt, or even something more modern, like Malthoid or a locally made product. By 1901 it appears that a bituminous roofing felt was being made in Australia by the Patent Asphaltum Co of Sydney, whose quaint trademark shows a map of Australia sheltered by a roof clad in their product.⁹⁴ Anderson & Co of Belfast made felt roofing as well as segmental timber girders and, as has been discussed above, showed a model of a 'wooden lattice girder felted roof' at Melbourne in 1888-9.⁹⁵ In the twentieth century Anderson's 'Rok' roofing felt was used in New Zealand, South Africa, India, and Formosa,⁹⁶ and was being sold in Australia by Noyes Bros of Sydney, Newcastle and Brisbane.⁹⁷

We will have occasion to again mention a gravel roof exhibited at Melbourne in 1854. In about 1884 the American manufacturers of Medal brand roofing and O.K. building paper, apparently one W H H Childs and his associates, referred to their original experiments in 1854 with the 'Felt and Gravel Roof'. The Medal brand roofing which they now marketed was said to be suitable for either steep or flat roofs, and consisted of three ply felt with two layers of 'water-proof composition' between the layers of felt. It was laid over boarding in long strips across the direction of slope, in successive layers from the bottom up, with a two inch [51 mm] overlap. The upper edge of the sheet forming the overlap was treated with the 'Medal Brand Mastic Roof Coating' made by the company, and then the upper strip was lapped over it and fixed with nails, each driven through a tin cap or washer shaped like a bowl, bottom upwards. Two layers of their coating were then added, and the upper one sanded. A two ply felt adequate for temporary structures was also available. The O.K. building papers supplied by the company will be mentioned below, and there was also an O.K. bituminous deadening felt for laying between

⁹³ James McCawley, *Roofing* (New York 1938), p 16. Diana Waite reproduces the advertisement of S M & C M Warren of Cincinnati in 1853 for composite roofing of tarred paper or felt 'saturated with either Carolina or Coal Tar': D S Waite, 'Roofing Early America', in C E Peterson [ed], *Building Early America* (Radnor [Pennsylvania] 1976), pp 145-6.

⁹⁴ Mimmo Cozzolino & G F Rutherford, *Symbols of Australia* (Ringwood [Victoria] 1987 [1980]), p 19.

⁹⁵ Centennial International Exhibition 1888-1889, *Official Record* (Melbourne 1890), p 459

⁹⁶ D Anderson & Son, Ltd, "*Rok*" *Roofing* (Manchester, no date [c 1930]), passim.

⁹⁷ C E Mayes, *The Australian Builders & Contractors' Price Book* (9th ed, Sydney 1927), advertisements p 13.

floors.⁹⁸ Early in the twentieth century Sears, Roebuck & Co were supplying houses with '3¹/₂-Ply Best-of-all Roofing'.

At the Paris Exposition of 1867 Maillard & Cie showed a roofing 'tile' based upon tar combined with mineral and other combustible materials, but it seems these may have been somewhat slab-like as compared with the thinner plates of later years.⁹⁹ An American product being marketed late in the century was 'Cyclone' felt, by Chapman & Soden of Boston, who advocated it as a slater's felt and as an indispensable foundation layer for gravel roofs. Samples of it are very thin and crisp, like a stiff dark gray card.¹⁰⁰ A recent claim that asphalt shingles were introduced by Herbert Reynolds in 1903 is patently incorrect.¹⁰¹ After the turn of the century the Philip Carey Manufacturing Company of Lockland, Ohio, was advertising 'Carey's Magnesians Flexible Cement Roofing'. A layer of asphalt cement composition was placed on a foundation of woollen felt, and a strong burlap embedded in the upper face. The burlap was in turn covered with a strong elastic paint, which dried to the colour of slate.¹⁰² By the 1920s 'Economy' asphalt roofing was sold in the United States in four forms: with a pure asphalt finish; with a flint surface on one side and talc on the other; with ground mica, and with chipped slate.¹⁰³

In about 1910 combination of wool felt and natural asphalt called 'Genasco' was on sale in New Zealand. It was said to be tough and leather-like, and was made in three weights, of which the median, or two-ply, was most commonly used.¹⁰⁴ By 1913 Genasco was on sale in Australia.¹⁰⁵ The original felt manufacturers in Britain developed their own proprietary roofing systems, and in 1950 D Anderson & Sons of Stretford, Manchester, were still marketing tarred felt roofing systems under the names 'Durok', 'Macasfelt' and 'Thermotile',¹⁰⁶ while McNeills made a flexible bituminous roofing called 'Combinite'.¹⁰⁷

f. asbestos products

During the nineteenth century asbestos came to be regularly used both in paints and in sheet materials. In 1870 an American roofing manufacturer, H W Johns, imported samples of asbestos from Italy, and an employee

⁹⁸ [? W H H Childs], *The Town & Country Roof* (no place or date [? 1888]), passim.

⁹⁹ R S Burn, *Modern Building and Architecture* (London, no date [c 1870]), p 77.

¹⁰⁰ Samples and trade literature in author's collection.

¹⁰¹ Jackson, 'Asphalt Shingles', p 248.

¹⁰² M S Ketchum, *The Design of Steel Mill Buildings* (2nd ed New York, 1909 [1903]), p 159.

¹⁰³ Chicago Millwork Supply Co, *Millwork and Building Material* (Chicago, no date [c 1925]), pp 46-8.

¹⁰⁴ G W Phillips, *Designs for New Zealand Houses & Residences* (Christchurch [New Zealand] no date [c 1910]), no page.

¹⁰⁵ James Moore & Sons Pty. Ltd., *Price List 96 August 1913* (Melbourne 1913), p 2.

¹⁰⁶ Evelyn Drury et al, *Architects', Builders' and Civil Engineers' Reference Book* (London 1950), pp 210-11.

¹⁰⁷ Drury, *Architects' Reference Book* [1950], p 212.

astonished onlookers by handling glowing coals while wearing gloves of the material. In the same year asbestos deposits were discovered in Quebec, and this was followed by finds in South Africa, Rhodesia, Russia and Cyprus.¹⁰⁸ The H. W. Johns Company of New York now made asbestos paint, 'asbestos roof coating', 'asbestos roof cement', 'asbestos fire and water proof sheathing', and 'asbestos roofing'. The coating was designed to be applied with a brush, and was a mixture of asbestos, silica and coal tar: the constituents of the cement are not described, but were probably similar. The sheathing was claimed to be 'the only strictly Fire and Water Proof Sheathing ever made', and was of pure asbestos, rendered waterproof by means of a 'recently discovered chemical process'. The roofing was 'the perfected Form of portable Roofing' which the company had made for twenty-eight years, and was made of strong canvas, combined with an asbestos coated felt and a manilla backing, waterproofed and compressed into a flexible sheet resembling leather.¹⁰⁹

Later on, this roofing was made by what had now become the H. W. Johns Co., and was described as consisting of a strong canvas foundation with asbestos felt on the underside, saturated asbestos felt on the upper side, and over this again a finishing sheet of plain asbestos.¹¹⁰ There is no record of the Johns products being used in Australia at this time, but similar ones were. In 1889 the architect Frederick Harrison recommended, for a dairy roof,

the Asbestos Roofing, supplied by the Australian Asbestos Manufacturing Co. ... in rolls 38½ inches [986 mm] wide containing 200 square feet [18.6 m²], and weighing with coatings complete 70 lbs per square of 100 super feet [3.4 kg/m²] ... It is thoroughly waterproof, and may be thrust in the fire for any length of time without injury. ... asbestos roofing is white, or light grey colour ...¹¹¹

The United Asbestos Company of London advertised in the *Australasian Federal Directory* of 1888-9: Salamander brand asbestos was recommended as best, but the company also supplied cheaper Canadian asbestos, and products including a millboard and a cloth, not apparently designed specifically for the building industry.¹¹² By the 1930s the the Nuroof Service Company were agents in Victoria the products of the Johns Manville Company, as it had become, and were contractors for asbestos roof installation.¹¹³

In 1914 Mayes lists asbestos roofing felt, which is described as a sandwich of bitumen roofing felt with asbestos fibre covering.¹¹⁴ He also lists Ruberoid,

¹⁰⁸ McCawley, *Roofing*, p 19.

¹⁰⁹ H W Johns Manufacturing Co, *Modern House Painting* (New York, no date [?c 1886], unpaginated).

¹¹⁰ Ketchum, *Steel Mill Buildings*, p 259.

¹¹¹ *Building & Engineering Journal*, 17 August 1889, p 151.

¹¹² *Australasian Federal Directory* (Melbourne, no date [c 1888]), part II, p 255.

¹¹³ *Journal of the Royal Victorian Institute of Architects*, XXXII, 4 (September 1936) p x.

¹¹⁴ C E Mayes, *The Australian Builders and Contractors' Price Book* (8th ed, Sydney 1914), p 29.

Malthoid, Resistoid Roofing, and Maltha roofing felts, in rolls of 4 by 72 feet [1.2 x 21.6 m], as well as 'P. & B. Ready Roofing, gravelled', in pieces of 32 x 40 inches [0.81 x 1.02 m]. Other felts are said to include Ruberoid cloth, Ruberoid red or brown roofing, Kaloroid (a coloured Ruberoid), Vulcantile (similar) and Ornamentile.¹¹⁵ By the mid-twentieth century asbestos played a major role in the Australian building industry, not merely in terms of felts, but also insulation products, such as the asbestos pipe insulation advertised by W H Brewer of North Melbourne.¹¹⁶ In 1954 William Crosby & Co of Melbourne were marketing 'Thermotile' roofing, a system patented and manufactured by D Anderson & Co, the British felt manufacturers. The tiles were made of asbestos and were placed over three layers of Anderson's 'Rok' roofing felt. They had completed a number of roofs of this type, including Prince Henry's Hospital, Melbourne, before obtaining permission to manufacture the tiles locally. The local product had been used in a number of prominent buildings, including the head office of the CSIRO in East Melbourne.¹¹⁷

g. Malthoid

Malthoid has already been mentioned in connection with the fashion for the flat roof, and the wider interest in the low-pitched Californian Bungalow, during the first decade of this century. However, it was used also for humbler structures, and for floors as well as for roofs. Karen Townrow has claimed that Malthoid was used for flooring at Macquarie Island in about 1892,¹¹⁸ but it seems unlikely to have been so early. At the Sniders and Abrahams cigarette factory in Drewery Lane, Melbourne, the flat roof was covered with Neuchatel asphalt to serve as a recreation area and skating [presumably roller skating] rink for employees, and the basement slab was also covered in asphalt, 25 mm thick, but the other floors had three-ply malthoid laid over felt.¹¹⁹ The first buildings put up by the Federal Government at Canberra in 1910 were construction huts both roofed and floored in the material,¹²⁰ and a surviving house of 1913 in Fortitude Valley, Brisbane, has what is believed to be original malthoid over the floorboards of the verandah and belvedere.¹²¹ In 1916 the builder R D Chapman constructed for himself the first Californian bungalow in Queensland, roofed in white malthoid.¹²² In 1919 a Malthoid advertisement claimed 'an unbroken record ... for over thirty-five years',¹²³ but while this may be an indication of the age of the material, it does not show that it had been used for such a period in Australia.

¹¹⁵ Mayes, *Australian Builders Price Book* (1914), p 31.

¹¹⁶ Wentworth & Richardson, *Ramsay's Catalogue* (1949), §26/1.

¹¹⁷ *Ramsay's Catalogue* (1954), §12/3.

¹¹⁸ Karen Townrow, 'Lovely Linoleum', *Australian Society for Historical Archaeology Inc Research Bulletin*, X, 3 (Spring 1990), no page.

¹¹⁹ *Building*, 11 June 1910, pp 23, 57-60, 62.

¹²⁰ Mitchell Library videodisc no 00100.

¹²¹ 521 Brunswick Street, Fortitude Valley: information from Robert Riddell, 1991.

¹²² M O Kennedy, 'Domestic Architecture in Queensland between the Wars' (MBitEnv, University of New South Wales, 1989), pp 83-4, citing *Building*, October 1916.

¹²³ *Building*, October 1916.

By 1911 H D Walsh, the Chief Engineer of the Sydney Harbour Trust, was able to say that he had 'for some years' used Malthoid to protect the top surface of timber beams used in wharf works. They tended to split when spikes were driven in to fasten the decking, and unless it was protected decay would set in at the crack. At no 4 Wharf, off Hickson Road, he used Malthoid between the three inch [76 mm] deck planking of the upper floor and the two inch [50 mm] sheathing on top of it, so as to make it watertight.¹²⁴ Malthoid can still be found on top of the beams at the Woolloomooloo Finger wharf, of 1913-15. 'Pabco' was a later version of Malthoid, with asbestos added,¹²⁵ and Graeme Butler refers to 'Hydrapult' asbestos reinforced roofing, used in Australia in 1913, as also being similar to Malthoid.¹²⁶ In America Sears Roebuck marketed an asphalt felt roof sheeting known as 'MarbleCore', because it was finished in marble to give it 'a beautiful silver gray color.'¹²⁷ Pabco Products were still selling Malthoid in Australia in 1954, but it was just one of a range of products such as Bitumenoid, Ormonoid, Rubanit, and Johns-Manville asbestos felt roofing.¹²⁸

h. proprietary materials

Ruberoid was an English invention of 1891, said to have been immediately successful and to have created 'an entirely new class of ... smooth surfaced, prepared, flexible roofings.'¹²⁹ It was described (at a later date) as a fibrous material saturated soaked with an unspecified compound which made it durable and chemical resistant. It was flexible, light and non-absorbent, and contained no tar, paper or rubber.¹³⁰ It was also low in cost, and became harder and more leathery over time. It was available in England in grey, red and green, and sold with a 'Ruberoid cement' for making the seams, which were fixed with galvanised clout nails.¹³¹ In the United States it was manufactured by the Standard Paint Co of New York as the 'P & B Ruberoid Roofing', and described as containing no paper at all, but a foundation of best wool felt (or wool and hair felt in the thinnest or half ply version), which was saturated with 'P & B water and acid proof compound', then coated with a bond solution of the same material.¹³²

¹²⁴ H D Walsh, 'The Gateways of Prosperity', *Building*, XXIV, 145 (12 September 1919), p 32.

¹²⁵ R A Prevost, *Australian Bungalow and Cottage Designs* (Sydney 1912), rear endpaper advertisement.

¹²⁶ Graeme Butler, *The Californian Bungalow in Australia* (Port Melbourne 1992), p 61.

¹²⁷ Sears, Roebuck and Co, *Sears, Roebuck Home Builder's Catalog* (New York 1990 [Chicago 1910]), p 136. The same finish was available on their rubber felt sheeting, as well as a flint surfaced asphalt roofing, a gravel burlap roofing (pp 138-9), and the more traditional 'Century' brand tarred felt roofing (p 140).

¹²⁸ *Ramsay's Catalogue* (1954), §12/5. See also 12/2, 12/4, 12/7, 12/8.

¹²⁹ G Jennings & Co, *Price List* (Bristol 1912), p 259. See also A D King, *The Bungalow* (Cambridge 1984), p 121.

¹³⁰ H Newbold [ed Edgar Lucas], *Modern Practical Building* (3rd ed, 4 vols, London 1950), II, p 321.

¹³¹ Jennings, *Price List*, p 259.

¹³² Ketchum, *Steel Mill Buildings*, pp 259-260.

By 1912 Hales Limited of Sydney were the wholesale distributors of Ruberoid for New South Wales, and advertised it for roofing, damp courses, lining and insulation.¹³³ It was used in Australia for flat roofing, and J Murray More Pty Ltd, the Melbourne agents, would contract to lay it using their own workmen.¹³⁴ At the Government Savings Bank, Sydney, Ruberoid was used for flooring, apparently in some of the more functional areas, AND IN THE ARERAS¹Ruberoid was later available not only in sheets but in the form of pseudo-slates or shingles.¹³⁵ It may have been the same as the 'Best-Ov-Al' rubber felt marketed in the United States by Sears, Roebuck & Co.¹³⁶

Maltha was made in Australia by William Fimmel & Co of Sydney, the same people who made the Maltha and Leadite damp proof courses.¹³⁷ Another Malthoid-like product, advertised in 1919, was Adamax Asphaltum Roofing, sold by William Adams & Co Ltd of Sydney, and consisting of long-fibred felt saturated with pure mineral hydrocarbon (bitumen).¹³⁸ 'Certain-teed' roofing, sold by agents throughout Australia, was apparently made by the Certain-teed products Corporation of the United States, which claimed to be the world's largest manufacturer of roll roofing.¹³⁹ Surviving samples, distributed by Wunderlich Ltd as one of the agents, are in one, two and three ply thicknesses, and were claimed to contain more bitumen than any other brand.¹⁴⁰ By 1919 John Bromfield Ltd of Sydney was selling 'Jaybee Roofing', the name of which seems to suggest that it was the company's own product. It was said to be the only roofing on the market which had a mica surface over flaked mineral composition.¹⁴¹

What sounds like a similar material was the 'Stoniflex' roofing produced by D Anderson & Co at their London mill, established about the turn of the century. They still used the 'Red Hand' brand with which they established themselves in Belfast half a century earlier. In 1904 they amalgamated with the Siderosteen Paint Company Limited, and began to produce their 'Rok' roofing.¹⁴²

In 1938 Mayes listed the felts available in one, two and three ply, all apparently locally made - Ormonoid, Ormonoid Challenge Quality, Malthoid, and Maltha, in addition to an imported felt, Genasco, which was available in from one to five ply, and, in the case of three ply, with an optional mineral

¹³³ *Salon*, I, 2 (September-October 1912), advertisement p 14.

¹³⁴ *Every Man's Home*, II (October 1922), p 42.

¹³⁵ Illustrated in Graeme Butler, *The Californian Bungalow in Australia* (Port Melbourne 1992), p 66.

¹³⁶ Sears, Roebuck, *Sears, Roebuck Home Builder's Catalog* (1910), p 137.

¹³⁷ Mayes, *Australian Builders Price Book* (1914), advertisements p 15.

¹³⁸ *Building*, 12 September 1919, p 25; and *Bulletin*, XL, 2032 (2 January 1919), p 2, as quoted in Peter Cuffley, *Australian Houses of the '20s and '30s* (Fitzroy [Victoria] 1989), p 146.

¹³⁹ *Building*, 12 September 1919, p 142.

¹⁴⁰ Wunderlich Ltd, *Certain-teed Roofing* [sample swatch in card cover] (Sydney, no date [?c 1920]).

¹⁴¹ *Building*, 12 September 1919, p 116.

¹⁴² Routley, *Saga of British Industry*, p 142.

surface.¹⁴³ There were also 'Oral' high grade sarking felt, S & K fibre-reinforced sound-deadening waterproof felt, P & B Asphalt Saturated Felt, a non-specific bituminous hair felt, and Trinidad roofing felt.¹⁴⁴ After World War II there came 'Rubanit', another bituminous felt roofing, finished in mica.¹⁴⁵ Rubanit were later to market 'Thermostop', an aluminium building paper, which will be discussed in the context of kraft and other building papers generally.

i. felt shingles

Although we have seen that asphalt shingles were of European and much earlier origin, we can for practical purposes accept the broad claim that they were a product 'distinctively American and of the twentieth century'. They were

manufactured of heavy strips of asphalt-saturated and coated felt in which is embedded a permanent mineral surfacing of crushed slate or flint, and are cut into strips and units, the strips measuring from 10 to 13¹/₂ inches [255-343 mm] in width by 3 ft [0.9 m] long ... cut at the butts in slots and other patterns to simulate individual units, and come in a variety of shapes from diamond designs to hexagonals.¹⁴⁶

'Oriental Slate Shingles' or 'Oriental Asphalt Shingles' supplied by Sears, Roebuck & Co with some of their pre-cut houses, were simple rectangles, but similar in type.¹⁴⁷ The idea of the 'multiple strip shingle' in which a single piece of material is shaped to give the impression of two or more separate units, has been erroneously claimed to date from Bird & Sons' 'Neponset twin' of 1906.¹⁴⁸ In the United States in the 1920s rectangular shingles were marketed of essentially the same materials as the 'Economy Chip Slate Roofing' discussed above, but somewhat heavier and more rigid, in addition to 'slab shingles' or strips of the material, notched along one edge so as to give the impression of four rectangular shingles when laid.¹⁴⁹

¹⁴³ C E Mayes, *The Australian Builders and Contractors' Price Book* (10th ed, Sydney 1938), p 28.

¹⁴⁴ Mayes, *Australian Builders Price Book* (1938), p 167. The Ormonoid products were those of Ormonoid Roofing and Asphalts Ltd of Waterloo, Sydney: *The Eastern Suburbs Builders Handbook and Diary 1939* (Sydney 1939), p 34.

¹⁴⁵ RAA WA Chapter, *Exhibition 1949*, pp 35-6.

¹⁴⁶ McCawley, *Roofing*, p 103.

¹⁴⁷ Sears, Roebuck & Co, *Modern Homes* (Chicago, no date [c 1910]), p 117.

¹⁴⁸ This was a single 12¹/₂ by 20 inch [320 x 510 mm] shingle with a slot tab dividing the leading edge. Mike Jackson, 'Asphalt Shingles', in Jester, *Twentieth-Century Building Materials*, p 251, attributes this to Sweet's *Catalogue* of 1906. I cannot locate it in Bird's advertisement, p 154. The brand 'Neponset' is here applied only to waterproof paper, and elsewhere (p 155) to insulating sheet. There is no reference in the catalogue to the 'twin' or to any other sort of multiple shingle. However Birds do advertise Neponset Twin Shingles, 20 x 12³/₄ inches [512 x 326 mm], at a later date: *Sweet's Architectural Catalogue* (New York 1922), p 1129.

¹⁴⁹ Chicago Millwork Supply Co, *Millwork and Building Material* (Chicago, no date [c 1925]), pp 46-7.

Various types of asphalt shingle and pseudo-shingle were sold in Australia from about 1910, amongst them 'Vulcantile', which was an asphalt felt roofing material shaped like tiles, and made in rolls containing two strips of these. It was available in a variety of colours, covered with crushed silica, quartz and rock crystals to give a glistening surface.¹⁵⁰ Ornamentile was a 'Vulcanite Bituminous Roofing' made in rolls cut to a shingle pattern, with crushed slate or minerals on the surface to give shades of grey, terra cotta, brown and grey-green.¹⁵¹

In the 1920s Ruberoid also came in the form of 'strip slates', or strips cut so that each gave the effect of four slates or shingles, each with the lower corners cut off at 45°, and these were used especially in gables to give the effect of shingle hanging. The top of the strip was the reverse of the bottom, with four projecting triangular tabs which were used for nailing. If alternate strips were laid upside-down, and contrasting colours were used, a pattern of large octagons and small squares on the diagonal resulted. The colours were Venetian red, sage green and blue.¹⁵² By 1927 the Victorian representative of the Paraffine Companies Inc of San Francisco was advertising Pabco 'Octar' shingles, which were made of Malthoid and produced exactly the same pattern of large octagons with small infilling squares of a contrasting colour (brown and red in the illustration). These were also in strips and were also described as having triangular tabs, but whether they were precisely the same shape as the Ruberoid strips is not known. They were described as 'split shingles' and were claimed to have an extra factor of safety because 'even when laid with the minimum amount of material, the triangular tabs along the upper edge fall directly below the cut-outs of the overlying rows, forming a three-inch lap at each cut-out.' Five nails were used for each shingle, four of them passing through the shingle below, so that nine fixing points were established.¹⁵³ A rare example of such shingles surviving - probably the Ruberoid type, as the colours seem to be Venetian red and blue - is a bungalow at 63 Piper Street, Kyneton, Victoria, where bands of alternate colours fill a main and a subsidiary gable.

¹⁵⁰ Mayes, *Australian Builders Price Book* (1914), p 265.

¹⁵¹ Mayes, *Australian Builders Price Book* (1914), p 31.

¹⁵² Butler, *Californian Bungalow*, facing p 68, p 61.

¹⁵³ *Australian Homes* (Melbourne 1927), pp 1, 147-8.